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10/767,727	01/30/2004	Vittorio Accomazzi	14604	6086

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EXAMINER	
RUSH, ERIC	

ART UNIT	PAPER NUMBER
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.**	**Applicant(s)**
	10/767,727	ACCOMAZZI ET AL.
	Examiner	**Art Unit**
	Eric Rush	2624

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 29 October 2007.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-18,27 and 28 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-18,27 and 28 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 30 January 2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Invention 1, claims 1-18, 27, and 28m in the reply filed on 10/29/2007 is acknowledged.

Claim Rejections - 35 USC § 102

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1-6, 9, 11-13, 15-18, and 27-28 are rejected under 35 U.S.C. 102(b) as being anticipated by Sheehan et al. U.S. Patent No. 6,106,466.

- With regards to claim1, Sheehan et al. teach an image processing system having a statistical appearance model for interpreting a digital image, the appearance model having at least one model parameter, the system comprising: a multi-dimensional first model object including an associated first statistical relationship and configured for deforming to approximate a shape and texture of a multi-dimensional target object in the digital image, (Sheehan et al., Column 12, Lines 8 – 11, Column 14 Lines 27 - 52) and a multi-dimensional second model object including an associated second statistical relationship and configured for deforming to approximate the shape and texture of the target object in the digital image, (Sheehan et al.,

Column 15 Lines 65 – Column 16 Line 25) the second model object having a shape and texture configuration different from the first model object; (Sheehan et al., Column 15 Lines 65 – Column 16 Line 25) a search module for applying the first model object to the image for generating a multi-dimensional first output object approximating the shape and texture of the target object and calculating a first error between the first output object and the target object, (Sheehan et al. Column 16 Lines 50 – 64) and for applying the second model object to the image for generating a multi-dimensional second output object approximating the shape and texture of the target object and calculating a second error between the second output object and the target object; (Sheehan et al., Fig. 13, Column 16 Lines 50 – 64) a selection module for comparing the first error with the second error such that one of the output objects with the least significant error is selected; (Sheehan et al. Fig. 13 Elements 238 & 244, Column 17 Lines 20 – 22) and an output module for providing data representing the selected output object to an output. (Sheehan et al. Fig. 1 Element 36, Column 17 Lines 41 – 48)

- With regards to claim 2, Sheehan et al. teach the system according to claim 1; wherein the first model object is optimised for identifying a first one of the target object (Sheehan et al., Column 12 Lines 8 – 23) and the second model object is optimised for identifying a second one of the target

object, (Sheehan et al., Column 16 Lines 50 – 64) such that the second target object having an shape and texture configuration different from the first target object. (Sheehan et al., Column 16 Lines 50 – 64)

- With regards to claim 3, Sheehan et al. teach the system according to claim 2 further comprising the digital image being one of a set of digital images, (Sheehan et al. Column 11 Lines 29 – 24) wherein each of the model objects are configured for being applied by the search module to each of the digital images of the set. (Sheehan et al., Column 12 Lines 24 – 42)

- With regards to claim 4, Sheehan et al. teach the system according to claim 3, further comprising the selection module configured for selecting one of the object models to represent all the images in the set. (Sheehan et al. Column 13, Lines 3 – 6)

- With regards to claim 5, Sheehan et al. teach the system according to claim 1; wherein the output is selected from the group comprising an output file for storage in a memory and a user interface. (Sheehan et al. Fig. 2, Column 8 Lines 3 – 12 and Column 8 Line 61 – Column 9 Line 3)

- With regards to claim 6, Sheehan et al. teach the system according to claim 2 further comprising a training module configured for having a set of training images including a plurality of training objects with different appearance configurations, (Sheehan et al., Column 12 Lines 8 - 33) the training module for training the appearance model to have a plurality of the model objects optimised for identifying valid ranges of the shape and texture of respective ones of the target object. (Sheehan et al. Column 13 Lines 55 – 65, Column 17 Lines5 – 13)

- With regards to claim 9, Sheehan et al. the system according to claim 2, wherein the first and second model objects represent different appearance configurations of the same anatomy of two different two dimensional slices taken from spaced apart locations of an image volume of the anatomy. (Sheehan et al., Column 11 Lines 22 – 28, Column 15 Line 65 – Column 16 Line 25)

- With regards to claim 11, Sheehan et al. teach the system according to claim 1 further comprising a predefined characteristic associated with the model parameter of the selected model object, (Sheehan et al., Column 12 Lines 8 – 61) the predefined characteristic for aiding a diagnosis of a patient having an anatomy represented by the selected output object. (Sheehan et al. Column 17 Lines 41 – 48)

- With regards to claim 12, Sheehan et al. teach the system according to claim 11, wherein the model parameter is partitioned in to a plurality of value regions, (Sheehan et al., Column 13 Line 66 – Column 14 Line 26) each of the regions assigned one of a plurality of the predefined characteristics. (Sheehan et al. Column 13 Lines 56 – 65)

- With regards to claim 13, Sheehan et al. teach the system according to claim 12, wherein the model parameter is selected from the group comprising a shape and texture parameter (Sheehan et al. Column 14 Lines 38 – 52), a scale parameter and a rotation parameter. (Sheehan et al., Column 14 Line 53 – Column 15 Line 10)

- With regards to claim 15, Sheehan et al. teach the system according to claim 12, wherein the output module provides to the output the predefined characteristic assigned to the selected output object. (Sheehan et al. Column 17 Lines 41 - 47)

- With regards to claim 16, Sheehan et al. teach the system according to claim 12 further comprising a training module configured for assigning the plurality of the predefined characteristics to the model parameter. (Sheehan et al. Column 12 Lines 43 – 61)

- With regards to claim 17, Sheehan et al. teach the system according to claim 15 further comprising a confirmation module for determining if the value of the model parameter assigned to the selected output object is within one of the partitioned regions. (Sheehan et al. Column 16 Lines 50 - 64)

- With regards to claim 18, Sheehan et al. teach the system according to claim 17, wherein the value of the model parameter when outside of all the partitioned value regions indicates the first output object is an invalid approximation of the target object. (Sheehan et al. Column 17 Lines 3 – 13)

- With regards to claim 27, Sheehan et al. teach a method for interpreting a digital image with a statistical appearance model, the appearance model having at least one model parameter, the method comprising the steps of: providing a multi-dimensional first model object including an associated first statistical relationship and configured for deforming to approximate a shape and texture of a multi-dimensional target object in the digital image; (Sheehan et al., Column 12, Lines 8 – 11, Column 14 Lines 27 - 52) providing a multi-dimensional second model object including an associated second statistical relationship and configured for deforming to

approximate the shape and texture of the target object in the digital image, (Sheehan et al., Column 15 Lines 65 – Column 16 Line 25) the second model object having a shape and texture configuration different from the first model object; (Sheehan et al., Column 15 Lines 65 – Column 16 Line 25) applying the first model object to the image for generating a multi-dimensional first output object approximating the shape and texture of the target object; (Sheehan et al. Column 16 Lines 50 – 64) calculating a first error between the first output object and the target object; (Sheehan et al. Column 16 Lines 50 – 64) applying the second model object to the image for generating a multi-dimensional second output object approximating the shape and texture of the target object; (Sheehan et al., Fig. 13, Column 16 Lines 50 – 64) calculating a second error between the second output object and the target object; (Sheehan et al., Fig. 13, Column 16 Lines 50 – 64) comparing the first error with the second error such that one of the output objects with the least significant error is selected; (Sheehan et al. Fig. 13 Elements 238 & 244, Column 17 Lines 20 – 22) and providing data representing the selected output object to an output. (Sheehan et al. Fig. 1 Element 36, Column 17 Lines 41 – 48)

- With regards to claim 28, Sheehan et al. teach a computer program product for interpreting a digital image using a statistical appearance model, the appearance model having at least one model parameter, the

computer program product comprising: a computer readable medium; (Sheehan et al. Column 8 Lines 3 - 15, Column 8 Line 61 – Column 9 Line 10) an object module stored on the computer readable medium configured for having a multi-dimensional first model object including an associated first statistical relationship and configured for deforming to approximate a shape and texture of a multi-dimensional I target object in the digital image, (Sheehan et al., Column 12, Lines 8 – 11, Column 14 Lines 27 - 52) and a multi-dimensional second model object including an associated second statistical relationship and configured for deforming to approximate the shape and texture of the target object in the digital image; (Sheehan et al., Column 15 Lines 65 – Column 16 Line 25) a search module stored on the computer readable medium for applying the first model object to the image for generating a multi-dimensional first output object approximating the shape and texture of the target object and calculating a first error between the first output object and the target object, (Sheehan et al. Column 16 Lines 50 – 64) and for applying the second model object to the image for generating a multi-dimensional second output object approximating the shape and texture of the target object and calculating a second error between the second output object and the target object, (Sheehan et al., Fig. 13, Column 16 Lines 50 – 64) the second model object having a shape and texture configuration different from the first model object; (Sheehan et al., Column 15 Lines 65

– Column 16 Line 25) a selection module coupled to the search module for comparing the first error with the second error such that one of the output objects with the least significant error is selected; (Sheehan et al. Fig. 13 Elements 238 & 244, Column 17 Lines 20 – 22) and an output module coupled to the selection module for providing data representing the selected output object to an output. (Sheehan et al. Fig. 1 Element 36, Column 17 Lines 41 – 48)

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 7-8, 10, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sheehan et al. U.S. Patent No. 6,106,466 in view of Steven C. Mitchell, Boudewijn P.F. Lelieveldt, Hans G. Bosch, Johan H.C. Reiber, and Milan Sonka, "Disease Characterization of Active Appearance Model Coefficients", MEDICAL IMAGING 2003.IMAGE PROCESSING 17-20 FEB. 2003 SAN DIEGO, CA, USA, vol. 5032, 17 February 2003(2003-02-17), pages 949-957, Proceedings of the SPIE - The International Society for Optical Engineering SPIE-Int. Soc. Opt. Eng USA.

- With regards to claim 7, Sheehan et al. teach the system according to claim 2. Sheehan et al. fail to teach wherein the appearance model is an active appearance model. Mitchell et al. teach wherein the appearance model is an active appearance model. (Mitchell et al., Section 1 Paragraph

2 – Paragraph 3) It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Sheehan et al. with the teachings of Mitchell et al. This modification would have been prompted because Active appearance models allow for the expected size, shape, and appearance variations in objects of interest.

- With regards to claim 8, Sheehan et al. teach the system according to claim 2. Sheehan et al. fail to teach wherein the first and second model objects represent different pathology types of patient anatomy. Mitchell et al. teach wherein the first and second model objects represent different pathology types of anatomy. (Mitchell et al. Section 1.1) It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Sheehan et al. with the teachings of Mitchell et al. This modification would have been prompted because Sheehan et al. suggest using their invention for a "plurality of three-dimensional reconstructions of the left ventricles in a population of hearts exhibiting a wide variety of types and severity of heart disease..." (Sheehan et al. Column 12 Lines 8 – 23) This modification would allow for the user to more quickly diagnose patients accurately.

- With regards to claim 10, Sheehan et al. as modified teach the system wherein the two different pathology types are represented by two different

training objects in a set of training images since the two different pathology types in the device of Mitchell et al. are represented by two different training objects in a set of training images. (Mitchell et al., Section 1.1 Paragraph 1 and Section 3 Paragraph 1)

- With regards to claim 14, Sheehan et al. teach the system according to claim 12. Sheehan et al. fail to teach wherein at least two of the predefined characteristics represent different pathology types of the anatomy. Mitchell et al. teach wherein at least two of the predefined characteristics represent different pathology types of the anatomy. (Mitchell et al. Section 1.1 Paragraph 1) It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Sheehan et al. with the teachings of Mitchell et al. This modification would have been prompted in order to allow for weights to be applied to these characteristics, which would therefore help a user more accurately diagnose patients quickly, accurately, and effectively with the aid of the systems.

Response to Arguments

6. Applicant's arguments filed 10/29/2007 have been fully considered but they are not persuasive.

- In pages 9-11 of the remarks Applicant's Representative argues that Sheehan et al. fail to teach the application of at least *two* different models for segmenting a single image, and asserts that only one model is involved. Applicant's Representative goes on to argue that Sheehan et al. should be interpreted as teaching the application of a single mesh model to multiple images. The Examiner respectfully disagrees. Sheehan et al. do teach the use of at least two different models for segmenting an image, Column 15 Line 67 – Column 16 Line 25 and Fig. 13 Element 236. In the cited passages of Sheehan et al. is described the updating of a mesh model based on patient images, which teaches/reads on the use of at least one image. During the adjustment/transformation of the mesh models many versions, i.e. different models for segmenting an image, are created and employed for the processing of patient images. The optimization process of Sheehan et al. therefore can be regarded as selecting the appropriate mesh model for use in calculation of patient parameters.

- In pages 11-12 of the remarks Applicant's Representative argues that Sheehan et al. fail to teach a selection module for comparing the error between the first model output and the second model output. The Examiner respectfully disagrees. Sheehan et al. do teach error comparison between a first model output and a second model output, Column 16 Lines 50 – 64 and Column 17 Lines 20 - 34. In these passages of Sheehan et al. they describe how errors between the patient images and an associated mesh

model are computed and compared with a threshold. The model outputting an error which is less than a predefined threshold is selected as the appropriate model. Although the errors are not put directly into a head-to-head comparison, the errors outputted by a first model and subsequent models are evaluated, which reads on comparing the error between the first model output and the second model output. The cited passages read on the claim because Sheehan et al. disclose a mesh model selection module which continuously evaluates the generated models in search of the model with the least acceptable error between the model and the images. Therefore, the model which is inevitably selected will have the smallest error since if the error is determined to be too large for one model the generation of a new model is outputted and compared again with an error threshold. This threshold is the link which is comparing the errors between a first model output and subsequent model outputs.

- In page 12 of the remarks Applicant's Representative requests clarification for the Examiner for support in Sheehan et al. for a predefined characteristic for aiding in diagnosis of patient. The Examiner refers the Applicant's Representative to Column 12 Lines 8 – 23, in which Sheehan et al. disclose a predefined characteristic, the three dimensional shape of a left ventricle and its range of shape variations. This characteristic defined in advance aids in determination of cardiac parameters which also define the three dimensional shape of a patient's hearts, Column 17 Lines 41 - 48, volume, mass, wall thickening, etc... These parameters then implicitly aid in the diagnosis of a patient's heart condition when compared with predefined characteristics of a diseased heart.

- In pages 12-13 of the remarks Applicant's Representative argues that Mitchell et al. fail to teach the use of at least two different models. The Examiner agrees with the Applicant's Representative but reminds the Applicant's Representative that Mitchell et al. are not relied upon for teaching the application of at least two different models but is brought into combination with Sheehan et al. to overcome the deficiencies of the claimed subject matter in claims 7-8, 10, and 14.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric Rush whose telephone number is (571) 270-3017. The examiner can normally be reached on 7:30AM - 5:00PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed can be reached on (571) 272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ER

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SUPERVISORY PATENT EXAMINER